BEAUFORTIA

SERIES OF MISCELLANEOUS PUBLICATIONS

ZOOLOGICAL MUSEUM - AMSTERDAM

No. 116 Volume 10 July 20, 1963

Some notes on the distribution and the ecology of the amphipod *Gammarus fossarum* Koch, 1835, in the Netherlands (Crustacea, Malacostraca)

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R.I.V.O.N. communication 139

Gammarus fossarum is a common species in the Balkan countries, Poland, Czechoslovakia, southern and central Germany, Austria, Italy, Spain, France, Switzerland, Luxemburg, and Belgium (SCHELLENBERG, 1942; STRAŠKRABA, 1962). In the Netherlands it reaches its north-western distribution limit, the species being recorded only from the extreme South-East of the country (South and Central Limburg, cf. HOLTHUIS, 1956; SMISSAERT, 1959).

In order to fix the distribution boundary more precisely, the author studied 232 samples of fresh water gammarids collected in practically every stream in the southern, central, eastern and north-eastern part of the Netherlands. On every collecting station, data on the following ecological conditions were gathered: water temperature, pH, current velocity, degree of pollution, bottom composition, vegetation, exposure to sun. *Gammarus fossarum* has been found in a number of new localities outside Limburg (table I).

TABLE I: Records of *Gammarus fossarum* in the Netherlands (outside Limburg).

sample	date	province	district	locality	number and name of topographical map	co-ordinates
73	16-5-62	Gelderland	Rheden	brook near hotel Beekhuizen	40 B Arnhem	1963 4477
76	16-5-62	Gelderland	Rozendaal	brook near the castle	40 B Arnhem	1947 4467
81	17-5-62	Gelderland	Renkum	brook on Hemelsche Berg	40 A Oosterbeek	1856 4436
82	17-5-62	Gelderland	Renkum	brook near Laag Oorsprong	40 A Oosterbeek	1852 4436
185	31-8-62	Gelderland	Ubbergen	spring on Wijler Berg	40 D Doornenburg	1929 4264
186	31-8-62	Gelderland	Ubbergen	brook on Duivelsberg	40 D Doornenburg	1928 4258

In the samples 73, 76, 81 and 82 *Gammarus fossarum* is found mixed with *Gammarus pulex*.

Received: March 12, 1963

Moreover, *Gammarus fossarum* has been found in a sample present in the Zoological Museum of Amsterdam, collected in 1949 by J. H. Stock near Gendringen (province of Guelders). A recent visit to this place yielded no further specimens of *Gammarus fossarum*. All the known records in the Netherlands are shown in fig. 1. The localities in the province of Guelders form the northernmost and westernmost records for the species.

Gammarus fossarum was described by Koch as early as 1835, but it took nearly a century before SCHELLENBERG (1934) clearly showed that Koch's form was sufficiently different from the common *Gammarus pulex* (Linaeus,

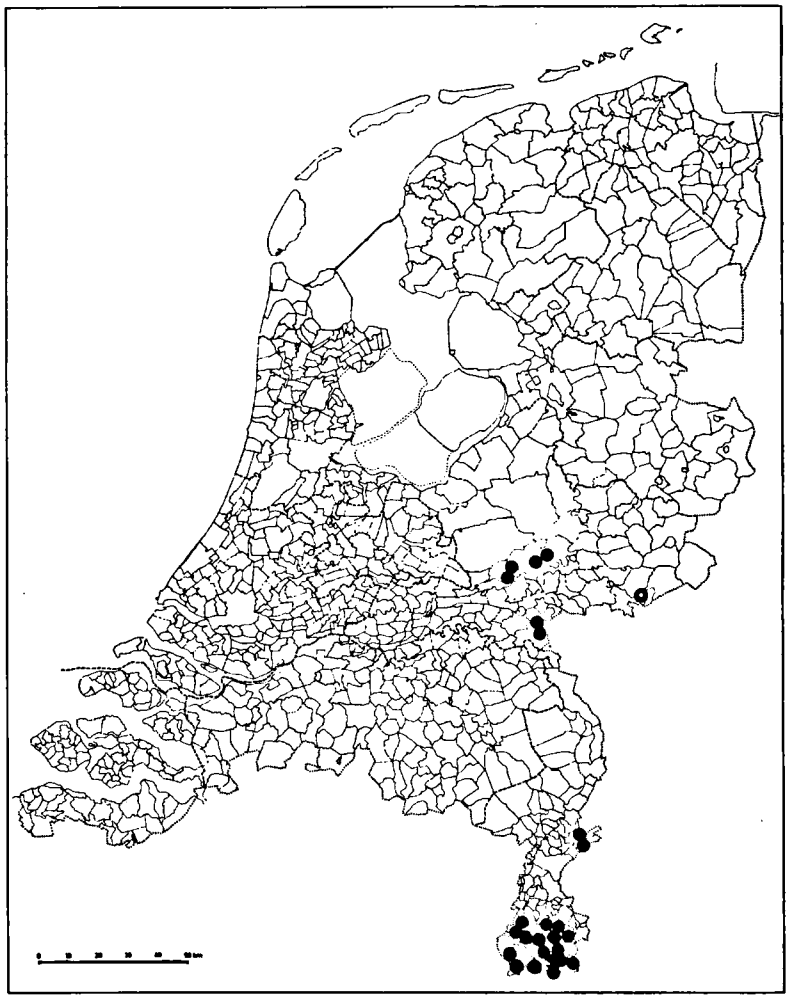

FIG. 1 : The distribution of *Gammarus fossarum* Koch, in the Netherlands. The closed circles represent localities in which the species has been recorded in 1962. Near Gendringen (the open circle) *Gammarus fossarum* has been collected in 1949, but was not found again in 1962.

1758) to justify at least a subspecific rank. Most of the recent authors followed Schellenberg and considered *fossarum* a subspecies of *Gammarus pulex*.

Gammarus delebecquei Chevreux & Guerne, 1892, though not identified with *Gammarus fossarum* by SCHELLENBERG (1934), was recently synonymized with *fossarum* by WAUTIER & ROUX (1959) and STRAŠKRABA (1962).

At first, SCHELLENBERG (1934) treated *Gammarus* (*Rivulogammarus*) *pulex* ssp. *danubialis* Karaman, 1931, as distinct from *fossarum*, but in a later publication (1937) he considered *danubialis* a junior synonym of it.

Taxonomic work of STRAŠKRABA (1962), WAUTIER & ROUX (1959) and ROUX (in press), and especially cross-breeding experiments of the two latter French authors strongly support the opinion that *fossarum* is not a mere subspecies of *Gammarus pulex*, but belongs to a separate species. All attempts to cross-breed specimens of *fossarum* and *pulex* in any possible combination failed (WAUTIER & ROUX; ROUX), nor have any illegitimate couples been found in nature. Experiments carried out with Dutch especimens (Mur, Wichers, unpublished) point in the same direction. For the moment, we thought it best to treat *Gammarus fossarum* as a full species. It is closely related to the widely distributed *Gammarus pulex*, but well-separable from that species, especially by the characters of the adult male, as the following table shows:

TABLE II: Differences between the adult males of *Gammarus pulex* and *Gammarus fossarum*

	Gammarus fossarum	*Gammarus pulex*
1.	length up to 18 mm	length up to 24 mm
2.	flagellum of antenna 2 not swollen	flagellum of antenna 2 swollen
3.	first segments of flagellum of antenna 2 long	first segments of flagellum of antenna 2 short and broad
4.	flagellum of antenna 2 without a row of setae at the lower margin	flagellum of antenna 2 with a row of setae at the lower margin
5.	last segment of pedunculus of antenna 2 has 6 (sometimes 5 or 7) insertions of setae	last segment of pedunculus of antenna 2 has 4 (sometimes 3 or 5) insertions of setae
6.	endopod of 3rd uropod 55% of length of first segment of exopod	endopod of 3rd uropod 75% of length of first segment of exopod
7.	None or one feathered setae on the outer margin of exopod of uropod 3	Many feathered setae on the outer margin of exopod of uropod 3

Gammarus fossarum is only found in unpolluted, running fresh water: in springs and in the upper reaches of streams. The pH in these localities ranges from 6.2—7.0. Sixty percent of the samples with *Gammarus fossarum* contain *Gammarus pulex* as well. Ecological observations of the 232 samples examined prove that water temperature, bottom composition, vegetation and exposure to sun are of no significance for the occurrence of *Gammarus fossarum*. Also current velocity does not play any important rôle, provided that the water does not become stagnant.

ACKNOWLEDGEMENTS

This study was sponsored by the "Rijksinstituut voor Veldbiologisch Onderzoek ten behoeve van het Na'uurbehoud" (R.I.V.O.N.), Bilthoven. I wish

to express my gratitude to Dr. J. H. Stock (Zoological Museum, Amsterdam) for his most helpful advice.

RÉSUMÉ

Gammarus fossarum Koch, 1835 est une espèce commune dans la partie sud du Limbourg (Pays-Bas), où elle est présente dans l'eau douce, non polluée, d'un pH de 6,2 à 7,0. Les études en campagne, effectuées en 1962 démontrent la présence de l'espèce à six localités en dehors du Limbourg, c'est-à-dire près d'Arnhem et de Nimègue, où elle vit dans les mêmes conditions qu'au Limbourg. D'ailleurs, il y a un échantillon de *Gammarus fossarum* au Musée zoologique d'Amsterdam, ramassé en 1949 dans un ruisseau dans la commune de Gendringen (la Gueldre), mais des recherches plus récentes ne découvrirent pas sa présence en cet endroit, fait probablement attribuable à la pollution actuelle de ses eaux.

Dans 60% des localités connues dans les Pays-Bas *Gammarus fossarum* coexiste avec *Gammarus pulex*. Leurs aires de répartitoin se recouvrent considerablement. Des hybrides ne sont pas encore connus, ni dans la nature, ni obtenus expérimentalement. D'ailleurs, la morphologie des mâles adultes est très différente.

Ainsi, *Gammarus fossarum* est considéré ici comme une bonne espèce et pas comme une sous-espèce de *Gammarus pulex*.

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